THE PEER HYPOTHESIS

PAUL BIRCH
48, Cliff Road, Cowes, IOW, PO31 8BN.

The debate into the existence of Extra-Terrestrial Intelligent beings has centred on the Fermi Paradox: "If they exist, where are they?". The arguments of the Anetist school, that ETI do not exist, have hitherto been attacked unconvincingly by SETI apologists. In this paper we examine an ETI hypothesis which escapes the Fermi Paradox in a novel way. We speculate that the Universe as a Whole might have been created by God, or engineered by some other powerful beings as a laboratory or zoo. We ask whether such experimenters would have included intelligent beings other than ourselves. We conclude that the history and development of any such ETI is likely to have been deliberately synchronised with our own; and therefore that any ETI we meet are likely to be more or less our equals or contemporaries. We call this the Peer Hypothesis. We discuss possible military consequences.

1. INTRODUCTION

Do Extra-Terrestrial Intelligent beings (ETI) exist? This question, the question of 'the plurality of worlds', has occupied the minds of philosophers for at least two thousand years [1].

The seminal paper of Cocconi and Morrison [2] pointed out how the radio emissions of other civilisations might be detected with modest radio telescopes. This made SETI a field of scientific enquiry and prompted numerous books and papers [eg. 3-6], culminating in the influential Cyclops Report [7]. This called for a massive effort to detect signals emanating from the millions of civilisations the authors expected to find littering the Milky Way. A number of more modest searches [8,9,10], including the famous Project Ozma [11], were actually carried out.

The scientific mainstream came to accept that such ETI civilisations were probably common throughout the Galaxy; and attempted to deduce the ways in which they might try to communicate with us. A substantial body of opinion even claimed that such ETI *must* exist; that it was inconceivable that Mankind was alone [12]. This belief was often embraced with great fervour, taking on religious overtones in the hope of 'salvation' from racial suicide [13,14].

Some scientists were doubtful. The Fermi Paradox, 'If they exist, where are they?', was posed again. Work on space colonisation and the possibility of interstellar flight [15,16] was beginning to suggest that Man's future lay in reaching for the stars and spreading throughout the Galaxy: no longer mere Science Fiction, but engineering designs employing real physics and comprehensible technologies. Now it could credibly be claimed that in a century or so, the blink of a cosmological eye, mankind will go to the stars.

The incompatibility of this probable future with the assumed prevalence of ETI was noted. If we expect to be able to colonise the Galaxy ourselves, why had not these aliens long since done the same? Hart [17] examined the paradox in detail and came to the simple conclusion that ETI probably do not exist. A growing body of scientists accepted the Hart argument and expanded upon it [18-23].

Unfortunately, I cannot find satisfactory labels in the literature for the two schools of thought: terms like pro-SETI/anti-SETI are inaccurate (both sides are in favour of *search*); and phrases like Drake-Sagan/Hart-Viewing chauvinists [23] may cause offense. So for convenience, by analogy with (dis)belief in God—(*a*)*theism*—I shall call (dis)belief in ETI (*an*)*etism*.

Adherents of the conventional view, that ETI are common in the Galaxy, I call *Etists*; and those who claim that ETI are rare or non-existent I call *Anetists*.

More and more scholars have left the Etist school as the strength of the Hart argument has sunk in. It may not now be unfair to claim that those who still cling to the prevalence of ETI usually have strong emotional or quasi-religious reasons [24]. The early concept of a 'Galactic Club' [3] of numerous ET civilisations of diverse ages spread throughout the Galaxy in a vast communication net should no longer be considered tenable.

Many attempts [25-38] have been made by Etists to find other answers to the Fermi Paradox and defeat the Anetists. However, an examination of these explanations shows them to be seriously flawed; it is apparent that their authors, almost without exception, have failed to come to terms with the full power and robustness of the Hart argument.

It is for example totally inadequate to argue that the Galaxy has not been colonised because immature civilisations destroy themselves, unless you can demonstrate that every single race will inevitably self-destruct in the short period before it achieves interstellar flight. For if just one group, of just one race, had ever in the entire history of the Galaxy succeeded in carrying through a propagating pattern of colonisation, then the Galaxy would have overflowed with them. The Hart argument will not fail unless it can be shown that no-one, at any time, out of all races everywhere, can follow any viable expansionist strategy; that this should happen purely by chance is ridiculously improbable [22].

It is crucial to appreciate that the Hart argument makes no critical assumption about the behaviour of alien species. It does not claim that *no* ETI civilisations will self-destruct. It is unaffected by any claim that *most* ETI sit at home and contemplate their extraterrestrial navels. It would not matter even if one could prove that *almost all* ETI societies find interstellar flight too expensive. All it asks is the absence of any universal law which absolutely forbids any species whatsoever from interstellar colonisation, a law which, if it existed, would contradict our present understanding of the only intelligent species of which we have knowledge.

The explanations that come closest to overcoming the Fermi Paradox are those based on the Zoo Hypothesis [39], wherein the Solar System is considered to be deliberately isolated from a community of 'mature' civilisations in the Galaxy.

Yet these explanations too are flawed, for they demand unbelievable unanimity in every civilisation in the Galaxy over vast spans of time, if no-one is ever to invade or exploit our reservation. They also fail to explain why our System should have been so quarantined in its early history, long before life started here.

Recently, Sagan has presented an entertaining work of fiction [40] in which a 'caretaker' race is left to oversee the evolution of races in the Galaxy; but the account is not wholly convincing.

Most authors fail to allow for continued technological progress, and drastically underestimate the likely capabilities of civilisations only a few thousand years older than our own, which may be expected to manipulate astronomical bodies on a grand scale; we could scarcely miss their activities [41,42]. The technological level assumed for supposedly billions-years-old communities of ETI is absurdly crude and restricted; it is unbelievable that they should remain so primitive so long.

A symptom of this small-thinking is the application of all ETI arguments by convention to 'The Galaxy'. Why restrict oneself to so small an entity? Intergalactic flight, colonisation and communication are not so very much more difficult than *intra*-galactic: stars are probably only about ten times further apart between galaxies as within them, for it is likely that very roughly half of all stars have been formed outside the galaxies proper or have wandered away from them.

The Hart argument has usually been presented in a very conservative manner: minimal starships travelling at moderate speeds, of order a tenth the speed of light or less; and only small numbers of colonising missions. Methodologically, as a counter to the Etist school, this is quite proper. However, it is highly unlikely to be adequate as a predictive scenario, for it assumes the very minimum of technological progress needed to make the argument work, and does not consider how much progress is in fact likely to occur.

When we allow even very modest further technological progress the Hart argument naturally extends to the colonisation and taming of the whole visible universe. I have shown elsewhere how this process can be achieved in only a few thousand years of historical time [43]. The SETI Zoo is far too small.

2 THE UNIVERSE AS ZOO

The above historical introduction demonstrates that the most likely explanation for the absence of extraterrestrials on Earth is indeed that ETI do not exist.

However, it may be of some interest to consider whether there are any other workable and credible explanations. The reader is warned that at first these speculations may seem extreme, but later we shall test them against the evidence.

Suppose that a race of beings, not unlike ourselves, develops a technological civilisation, and grows in knowledge and power. In time they learn how to travel from star to star, galaxy to galaxy, to build with planets and stars and black holes, to manipulate the structure and topology of space-time. We can place no limits on their technology; except that we should expect them to achieve at least as much as we can conceive with our present science, and almost certainly far more.

In due course they learn how to manufacture their own space-times at will, and populate them with creatures of their own devising. Perhaps they learn to adjust the flow of time in these new universes, to view them speeded-up at a more convenient rate; perhaps they fast-forward over the boring evolutionary aeons, or simply fake them [44].

Such universes might be built and controlled by a single entity or a group of like-minded beings; no doubt they could readily be protected from interference for the period of the experiment or drama, much as we keep a small zoo on our own property reasonably inviolate during our own lifetimes. Other ETI 'gods' would not try to seize such a universe as territory any more than we would seize a rabbit hutch; it would be too paltry: they could more easily make or purchase their own. Though there might still be vandals, crooks or 'devils' who might smash it up or steal it from its rightful owner.

Could it be that we live in such an engineered Universe?

From our point of view, it would be difficult to distinguish an engineered universe from one simply created by God, unless the Creator or creators deliberately made themselves known in it, or until we progressed to a similar level ourselves.

There is an important philosophical distinction: God creates all things (however many universes there may be) out of nothing, and sustains them as an infinite ground of being [45]; ETI 'creators' would merely be people with a high technology, manufacturing worlds out of the substance of their already-existing super-universe, not really as 'gods' but rather as engineers. They would still be finite in their powers (or at least infinitely weaker than God), and would themselves ultimately have been created by God Himself.

Nevertheless, we should find it hard to tell the difference. Can we judge the workmanship of the universe to see if it be God's alone, or can we find flaws attributable to imperfect engineering? It is hard to claim that we can.

If we have been created by God or ETI we can expect to have been built in His or their 'image', that is, to be able to think in a similar manner; and we could expect to be able to understand His or their motives and choices to some extent. Might God's motives appear more 'religious' and those of ETI more 'experimental'? It would be hard to be sure.

Nor could we readily expect to learn how many different groups, races and species of ETI exist in the super-universe, because we should probably be the work of only one of them.

This is a far cry from the conventional SETI scenario of assorted ETI scattered through the Galaxy.

Does such speculation really have a place in science, or is it theology or science fiction? We should realise that if SETI is at all a proper field for science, then it deals fundamentally with the effect of intelligent life upon the universe. Questions of the origin, development and purpose of the universe and its inhabitants cannot legitimately be ignored, even though perforce they stray into areas of philosophy and theology.

Astronomers must switch from a paradigm in which life is a negligible anomaly in an inanimate universe, to one in which it is recognised that intelligent life develops (almost inevitably) to become the principal arbiter of the shape and evolution of the universe. Could it be that everything we see *is* artifact, and that the notion of a "natural" world is unfounded?

3 THE PEER HYPOTHESIS

If our universe has been deliberately created by God, or manufactured by advanced ETI, how may we expect it to be populated? It is clear that it will have been populated according to the wishes of the Maker or makers, rather than according to impersonal laws of physics and biology alone.

There seem to be three broad possibilities:

1) Only Mankind has been created: ETI do not exist within the universe. This is clearly consistent with the evidence and the Hart argument. It is also a reasonable scenario for the Maker or makers to choose.

2) Many ETI have been allowed to develop naturally in the universe on astronomical time-scales. This brings us back to the conventional ETI scenario which is clearly inconsistent with the evidence and the Hart argument. We can rule it out.

3) Many ETI have been created, but their development has been deliberately arranged and guided so as to be roughly contemporaneous with our own. This interventionist universe is quite different from our usual astronomical intuition, but it will be shown to be consistent with the evidence and the Hart argument.

The third possibility is the interesting one. We shall call it the 'Peer Hypothesis'. This may be expressed as: "The ETI in our universe are our peers or equals". It embodies the Principle of Mediocrity, sadly weakened by Etists in their attempts to explain away the Fermi Paradox, in its strongest form. This principle, the notion that neither Earth nor human beings are anything out of the ordinary, has been the cornerstone of SETI apologists from the outset, yet it also gives the Hart argument its strongest support.

The Peer Hypothesis allows us to accept many SF scenarios without gagging on the astronomical coincidence of finding so many alien races at pretty much the same level as ourselves—within a few hundred or a few thousand years. More important, it allows us to play with the possibility of ETI in our neighbourhood without being stumped by the apparent absence of extraterrestrials now on Earth.

Under the Peer Hypothesis we must assume that Earth is probably neither astonishingly advanced nor very backward, but rather is typical of the developmental level of ETI throughout the universe.

Why should this be? Simply because our Creator or creators will want our universe to be interesting and eventful. History is at its most diverting when many groups interact, and when their capabilities and interests are neither wildly disparate nor absolutely identical—in the former case the result would be a foregone conclusion, in the latter the toss of a coin, neither very startling or informative.

There are many motives that would lead to a preference for such an eventful universe: for the challenge of creating it; for the challenge of understanding it; for the challenge of predicting its outcome; for its aesthetic qualities as a work of art; for entertainment; out of idle curiosity; to pursue knowledge for its own sake; to gain useful data; to provide the greatest opportunities for ones 'children' or creations; to provide a challenge for ones creations; to enrich creation; to earn money; to win a bet...

Many motives and combinations of motives are conceivable, leading to the same result; a universe apparently like ours, containing many ETI at not dissimilar levels of development.

4 THE CULTURAL DEVELOPMENT OF ETI

What is the likely range of development of the ETI in our universe under the Peer Hypothesis? Probably not enormously greater than we have on Earth, perhaps a spread several times as wide.

On Earth, in historical times, we find cultures more advanced and less [46]. The distribution of the development level of human cultures is non-gaussian and single-sided (Fig. 1): most cultures or peoples bunch up towards the most advanced, the remainder trailing behind by varying amounts. A few may trail a long way behind, as much as 10,000 years. But none will be very much in advance of the norm.

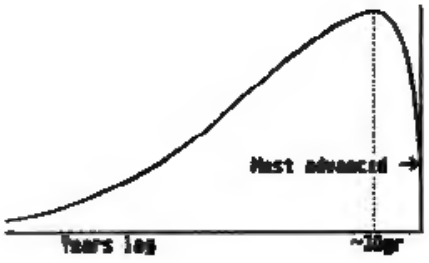

Fig. 1 Distribution of cultural development

In the Old World the ancient civilisations of Egypt and the Sumerians appeared around 3500 BC; by around 2500 BC civilisation was established across Mesopotamia and the Mediterranean; China and then India arose somewhat later, around 1500 BC. Even within the 40000 years of *Homo sapiens sapiens* or the 10000 years of agriculture this is not a wide dispersion.

Trade, wars and mass migrations led thereafter to a convergence of culture: most developments were matched within a few hundred years across the continent, the impetus for progress arising mainly—but not exclusively—in the West. Barbarians were gradually absorbed into the surrounding civilisations.

Although the civilisations of the Americas, the Incas, Aztecs and Mayas, are often described as 'ancient' and seem to have developed independently of the Old World, they did not arise until much later—around 500 AD. This two or three thousand year gap may be indicative of the range of development epochs in ETI.

The most backward peoples are now uncivilised aborigines and bushmen, or the primitive tribes of New Guinea and South America. Most of these are not true primitives: in contrast to Rousseau's romanticised 'noble savage', most are degenerate remnants of earlier more advanced cultures—like those of the Incas or Aztecs.

Sub-Saharan Africa, however, has remained relatively isolated and backward into this century. It may be more representative of primitive ETI than the degenerate tribes mentioned above.

As we approach the present day, differences within the civilised world have narrowed, presumably due to the increase in travel, trade and communication. The peak of the distribution is probably now only about 30 years behind the leaders—in some fields considerably less. This may be representative of the more advanced ETI, if the progress of each race has been prompted and guided in such a way as to converge with that of all the others.

As to the exact nature of this guidance, we can only guess. Various notions could be drawn from religious writings or from Science Fiction. All we need say is that we might expect the guidance of the Creator or creators to be given in a subtle way that could not *incontrovertably* be recognised as such.

It is not likely that we are among the more backward races in this neighbourhood; for if we were, the more advanced ETI would be here already. Nor is it probable that we are actually in the lead. But we may well be within a hundred years or less of the leaders. Not by chance, I emphasise again, but by the intentional working-out of the plans of our Creator or creators, through deliberate but subtle intervention or participation in our history.

This then is an indication of the spread of ETI capability that could be predicted under the Peer Hypothesis.

5 THE CHARACTER OF ETI

As to the bodily form of ETI the Peer Hypothesis can give little help, except to say that most are unlikely to be enormously bigger or vanishingly smaller than ourselves. Their lifetimes are unlikely to be extremely short or their generation times extremely long.

As to the character and behaviour of ETI the Peer Hypothesis and the Principle of Mediocrity suggest their similarity to ourselves, yet with a diversity of cultures: neither so alike that we cannot learn from them, nor so different that we have no point of contact. Both understanding and mis-understanding will be possible. Their motivations will be our motivations, adapted to their own circumstances; different as the aborigine and the Roman scholar; alike as the Eskimo and the Chinaman. The universe will be the earth writ large.

Many Etists have claimed that advanced ETI will necessarily be peaceable and benevolent [14]; they will have ended all war, removed all injustice. In my opinion, this is wishful thinking. What evidence we have—and it is slight—suggests rather that more advanced species are if anything *more* ruthless as predators of lower species.

Yet even if the Etists are correct, and all truly advanced ETI are indeed benevolent, it does not help us here. For under the Peer Hypothesis the aliens are little more advanced than we ourselves; and so they will be heir to all the failings of Mankind—and perhaps to others too.

Some will be gentle. Others will be warlike. Few will be either totally pacific or implacably hostile. Most, like Mankind, will be capable of either form of behaviour. Some will be honest. Others will be cheats. Few will be either completely reliable or absolutely untrustworthy. Most, like Mankind, will be capable of either form of behaviour. Some will love aliens. Others will hate them. Few will be either totally enamoured of them or utterly abominate them. Most, like Mankind, will be capable of either form of behaviour.

I think the point is made. If, as so often in Science Fiction, we take the history of the world and rewrite it for the larger stage, our prophesy will not be unreasonable.

The nature of ETI can be expected to include all human nature: the bad as well as the good.

6 ETI AND THE FUTURE

The Peer Hypothesis predicts an interesting future in which ETI will soon play a major part.

In the past no advanced technological civilisations had yet been allowed to develop in the universe, and so there was no interstellar communication, no interstellar travel and no astroengineering. There were no extraterrestrials on earth, for there were none capable of journeying here.

Only now are the races of the universe moving out into space. Kardashev Type II and III civilisations [47] do not yet exist; we see the galaxies still in their pristine state and the distant ETI are still not visible. But the nearer ones may soon be seen.

Mankind is now a technological civilisation, capable of interstellar communication, capable of limited forays into planetary space, soon to be capable of interstellar flight—analysis of the problem of interstellar flight [48–50] suggests that we *could* reach the nearest star as early as 2020 AD, more probably by around 2070 AD, almost certainly by 2200 AD.

The more precocious ETI may already have interstellar flight. If they inhabit any of the nearer star systems like α-Centauri, τ-Ceti or ε-Eridani they could be on their way here right now. They could arrive at any time.

Yet under the Peer Hypothesis they could hardly have been expected to get here more than a few decades ago, unless we had been a particularly backward race. It is in the decades to come that we are now most likely to hear from them or meet them, as they come to us or we go to them.

Suppose a race of ETI developed interstellar flight around 1970. That would put them maybe 50–100 years ahead. If they live 25 light years from Earth they would first have detected our World War II radars at about the same time. Setting out at once, they could arrive here by about 1995. If they live closer they could have more time to prepare and still be on the doorstep. If they lived at α-Centauri they could have arrived ten years ago in 1980. But if they live more than about 50 light years away it becomes unlikely that they will get here before we in our turn develop interstellar flight.

The Peer Hypothesis favours eventful scenarios in which First Contact may occur by visitation from outer space without warning. If the Creator or creators chose to make the mean ETI separation ~50 ly or smaller, a more advanced race could then detect the early radio signals of a less advanced race and arrive by starship *before* the other had time to achieve interstellar flight itself.

For interest's sake some not-too-backward races should also be discovered by exploring starships *without* prior radio detection. The exploration of all stars within a given radius takes longer than journeying to a single star, for the total number of stars increases rapidly with distance. Examining all likely stars (~50) within 25 ly may take about a century after the first interstellar flight. So to include these scenarios the mean ETI separation should not be much greater than ~25 ly.

But if the mean separation is too small (less than around 10 ly) there will almost always be some precocious ETI within 20 ly, who will contact nearly all the rest before they can develop interstellar flight for themselves. This would make for less interesting scenarios.

Putting this together, we find the Creator or creators most likely to choose a mean ETI separation of ~25 ly. For most races First Contact will then occur within a spread of about 200 years, equivalent to about 1950–2150, with the most probable epoch being about 2050. We might expect that roughly as many races will achieve full contact with another before interstellar flight as after; whereas first radio detections will peak perhaps 20 years earlier.

Of course, these numbers can only be taken as indicative of a probable range of values; considerably wider separations cannot be ruled out. Indeed, it would seem that the distribution of ETI is more likely to be clustered than uniform: in particular, a fractal distribution will give examples of all scales of separation and maximise the diversity of possible ETI interactions. Nevetheless, even when ETI sites are highly clustered, the most probable distance to our nearest neighbour can still be expected to be of order 25 ly.

Once First Contact has occurred, successive contacts will come thick and fast. This is because the next-nearest neighbour will only be 25% further away on average than the nearest and will gain contact in another five or ten years. Thereafter the rate of contact will increase without limit. It is noteworthy that the longer first contact is delayed the shorter the interval to the next contact is likely to be.

We may question the validity of this scenario in view of the failure of Project Ozma and other searches to detect the presence of ETI at ε-Eridani and other nearby stars. But Project Ozma was searching for deliberate CETI emissions. A similar project carried out by ETI at ε-Eridani today would likewise fail to detect Mankind. A search for inadvertant transmissions—especially TV and radar—might be more successful.

But we need not necessarily expect to see nearby ETI yet, if their technology is still pre-World War II, or if they make greater use of spread-spectrum signals (which look like random noise and are very hard to detect). Radio searches of the nearer stars (out to ~50 ly) would certainly be worth carrying out, but there could be no guarantee of success. Only a physical probe would give an unequivocal negative answer.

It is now apparent that, unlike other ETI hypotheses, the Peer Hypothesis shows why we may expect the immediate future to be especially interesting, the time when things really start to happen.

7 MILITARY IMPLICATIONS

The military implications of the Peer Hypothesis are by now becoming apparent.

In conventional ETI scenarios practically all ETI are either far more primitive or far more advanced than us. The primitives pose no threat. Advanced ETI are far too powerful to fight; we can only hope they prove friendly. This is probably why SETI apologists argue for the benevolence of ETI.

(The supposition that once a good crop of 10^{10} humans has been grown they will harvest us and torture us all to death would be most uncomfortable; though it is not intrinsically any less likely than many another ETI idea and has been used with great effect in SF.)

Even if highly advanced ETI exist there are few *practical* military implications. I doubt if it is even worth eliminating war to please them—for all we know they may put up with us just *because* we fight wars.

The Peer Hypothesis is rather different. In this the ETI are neither so powerful that we could not defeat them, nor so weak that we could not lose to them. Our stance will make a difference.

Consideration of the *military* implications of the Peer Hypothesis is appropriate here, not because I believe that First Contact will inevitably lead to war, but because war is one of the possible outcomes.

If we meet ETI, no doubt we shall attempt to open diplomatic relations with them; we shall hope to find them comprehensible and accomodating, and hope for mutually beneficial trade and the exchange of scientific data. But such diplomacy may not always succeed, any more than it does on Earth—it seems to me most unlikely that such alien contact would *never* lead to war.

Why then might interstellar warfare come about? SF has explored many avenues, and even if we reject the sillier ideas—like stealing Earth's oceans—we are left with a plethora of possibilities. Like Mankind, ETI will want to increase their wealth, and to spread their culture, their religions, their political dogmas and their population. They may want to use the resources of energy and mass the Solar System contains; they may or may not want human subjects. And they may be prepared to go to war to get what they want. The causes of war are always debatable and often appear foolish to bystanders. The fact is: wars happen.

Under the Peer Hypothesis potential aggressors should not be too far ahead of us. Moreover, they would apparently be condemned to using *obsolete* technology, perhaps out of date by 25 years or more (the duration of the journey), and would be restricted to limited resources at the end of a very long line of communication. This would give us an edge.

But if there are ETI who would plunder a defenceless Earth (and a starship can be a devastating weapon in its own right), the very fact of being prepared for interstellar war may deter the aggressors and help avert it.

It is apparent that this analysis of the Peer Hypothesis is leading us now into the realms of politics—of which scientists are rightly wary—but it would be lax and cowardly of me not to carry through to draw the relevant conclusions. I ask those who find them distasteful not to reject the Peer Hypothesis on that account: the truth does not have to be pleasant.

If Mankind were to be conquered in such an interstellar war, at best the aliens might leave us our culture and much of our freedom; or else they might make us slaves and treat us like cattle. Or they might simply choose to exterminate us.

If we remember how badly we humans often treat foreigners of our own species, it does not take much imagination to appreciate that alien species might treat one another far worse.

Thus interstellar warfare, if it arises, may be for the very highest stakes: the very survival of the human species.

If this is true we must be ready to defend ourselves, whatever the cost. For even if the threat of extinction is only of a low probability it is so serious a contingency that we must guard against it.

I suggest that actions we *can* take in the near future would very much improve our chances of coping with the arrival of ETI. Control of space is vital: if we allow the aliens the freedom of the skies we cannot hope to withstand any aggression, for they need only throw rocks at us until we surrender or die. Thus a prerequisite to the defence of Earth is a strong presence in space, demanding the construction of space colonies, the mining of space resources, the development of space transportation. Sentinel observatories and distant early warning lines could then be deployed (to reveal the imminent arrival of probes and starships), space weaponry devised, and space battleships built and armed.

Even if these things should become a costly burden upon Earth's economy, they would still have value as a bulwark against the loss of everything we hold dear—indeed against the loss of *absolutely everything*. In practise I believe that the economic returns would be so vast that the expenditure would be fully justified even in the total absence of any threat.

Thus the military implications of the Peer Hypothesis are that the safety of Mankind may rest upon our armed strength in space.

8 CONCLUSIONS

We have found that the Peer Hypothesis, though at variance with the conventional view of the astronomical universe, is fully consistent with the available evidence and arguments. It illuminates the question of the origin of life and the prevalence of intelligence. It answers the Fermi Paradox. It is weird. It is speculative. But it seems to work.

How likely is it then that the Peer Hypothesis—or something like it—is actually true? Perhaps not very: and yet it is probably not so very *unlikely* either. For what it may be worth I list the following possibilities in decreasing order of my *personal* estimate of their likelihood:

Mankind is unique. The universe is infinite, ruled not by chance but by God; *or*

Mankind is unique in this universe, but God has created and peopled other universes; or

Mankind is not unique. God has created and multiply-peopled this universe with our peers; or

Mankind is unique. The universe is finite; or

Mankind is not unique. Advanced ETI have created and peopled this universe; or

Mankind is not unique. Diverse ETI have arisen naturally in the universe.

The Peer Hypothesis is some way down my list. Nevertheless, because it leads to definite predictions for the near future, predictions that have more than academic significance, I contend that we should take it seriously. If it is true, the consequences could be catastrophic. We need insurance. It is therefore encumbent upon us to give timely thought to the accumulation of a new military infrastructure in space as a defence against possible extraterrestrial attack.

The absence of extraterrestrials on earth can most readily be explained by the claim that ETI do not exist. But we have devised another class of explanation, the Peer Hypothesis. It could be true.

If so, perhaps indeed this universe abounds with ETI, our peers and neighbours. And perhaps we shall meet them very soon.

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